REMARKS

This application has been reviewed in light of the Office Action dated November 28, 2003 (Paper No. 11232003). The specification is amended in response to the Examiner's request that an explanation of the term "glass forming region" be provided. Claims 11, 24-25, 27-37, and 39-42 are amended. Claims 1-10, 12-23, and 26 are canceled without prejudice to the underlying subject matter.

Claim 11 stands rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,761,115 to Kozicki et al. (hereinafter "Kozicki '115"). This rejection is respectfully traversed.

Independent claim 11 has been amended to incorporate additional limitations, including limitations from now-cancelled dependent claim 15. Claim 11 as amended defines a non-volatile memory cell and recites a germanium selenide glass comprising silver and "having the formula $(Ge_xSe_{1-x})_{1-y}Ag_y$, wherein $39 \leq x \leq 42$ and y corresponds to a stoichiometric amount of silver suitable to maintain said germanium selenide glass in a non-crystalline state.". Claim 11 further recites "a first electrode and a second electrode electrically coupled to said germanium selenide glass." Such a memory cell is not disclosed by Kozicki '115.

Kozicki '115 fails to disclose every element in claim 11 as amended. Specifically, while claim 11 recites the formula "$(Ge_xSe_{1-x})_{1-y}Ag_y$, wherein $39 \leq x \leq 42$," Kozicki '115 fails to disclose <u>any</u> specific germanium selenide stoichiometry. The Office Action states at ¶ 14, p. 14, that "Kozicki et al do not necessarily claim the further limitation of claim 15," the stoichiometric limitation of which, as explained above, is now included in claim 11 as amended. Furthermore, Kozicki '115 fails to disclose "a stoichiometric amount of silver suitable to maintain said germanium selenide glass in a non-crystalline state," as recited in amended claim 11. For at least these reasons, claim

11 as amended is allowable over Kozicki '115. Applicant respectfully requests that the 35 U.S.C. § 102(b) rejection thereof be withdrawn.

Claims 15, 25, 31, 36, and 42-43 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kozicki '115 in view of Mitkova et al. (Phys. Rev. Lett. 83 (19), 3848-51 (1999)) (hereinafter "Mitkova") and U.S. Patent No. 6,487,106 to Kozicki (hereinafter "Kozicki '106") as noted. Claim 15 has been canceled and its subject matter incorporated into claim 11. Applicant respectfully traverses the remaining rejections and submits that claim 11 as amended (which now recites additional limitations, including limitations from claim 15) is also allowable over the cited references.

The Office Action states that it would have been obvious to combine the teachings of Kozicki '115, Mitkova, and Kozicki '106 to obtain the invention now claimed in claim 11. As stated earlier, claim 11 now recites a "non-volatile memory cell comprising: a germanium selenide glass comprising silver, said germanium selenide glass having the formula $(Ge_xSe_{1-x})_{1-y}Ag_y$, wherein $39 \leq x \leq 42$ and y corresponds to a stoichiometric amount of silver suitable to maintain said germanium selenide glass in a non-crystalline state; and a first electrode and a second electrode electrically coupled to said germanium selenide glass." See claim 11.

Kozicki '115 discloses a programmable metallization cell structure incorporating a fast ion conductor and a plurality of electrodes. The Office Action acknowledges that Kozicki '115 does not disclose the germanium selenide stoichiometry claimed in the present application. It continues, however, that in view of Mitkova, "it is well known among those of ordinary skills that the glass forming region II extends over germanium concentrations from about 38% to about 46%," citing Kozicki '106 as an example of a prior art reference disclosing this supposedly well known germanium selenide stoichiometry. The Office Action concludes that therefore,

Kozicki '115, Mitkova, and Kozicki '106 may be combined to render claim 15 obvious. Applicant respectfully submits that claim 11 as amended is not obvious over Kozicki '115, Mitkova, and Kozicki '106.

To establish a *prima facie* case of obviousness, three requirements must be met: (1) some suggestion or motivation, either in the references themselves or in the knowledge of a person of ordinary skill in the art, to modify the reference or combine reference teachings; (2) a reasonable expectation of success; and (3) the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation for success must both be found in the prior art and not based on Applicant's disclosure. M.P.E.P. § 2142. See, e.g., In re Royka, 490 F.2d 981 (CCPA 1974). These requirements have not been met and, thus, the Office Action does not set forth a *prima facie* case for obviousness.

There is no motivation or suggestion in Kozicki '115, Mitkova, or Kozicki '106 to combine these references. The Office Action does not set forth any motivation or suggestion to combine these references, and indeed no such motivation or suggestion exists. Although Kozicki '115 and Kozicki '106 mention that germanium selenide is used in their programmable memory devices (see, e.g., Kozicki '115 at col. 5, lines 25-26), the Kozicki references provide no motivation or suggestion to apply the stoichiometric ranges disclosed in Mitkova to the teachings of Kozicki '115 and Kozicki '106. In fact, Kozicki '115 discloses no germanium selenide stoichiometry whatsoever. Kozicki '106 mentions a germanium selenide stoichiometry ($Ge_{30}Se_{70}$) only in passing, and while that stoichiometry falls within Mitkova's glass forming region I (which includes quite a broad range of germanium values: 0% - 33%), see Mitkova at 3848, Mitkova does not mention that stoichiometry specifically.

Mitkova also does not provide any motivation or suggestion to modify the teachings of Kozicki '115 or Kozicki '106 with its disclosure. Mitkova explores the stoichiometric ranges where germanium selenide with silver additive remains in the glass phase, but provides no indication that maintaining germanium selenide in a glass forming region improves a memory cell incorporating germanium selenide, and does not provide motivation or suggestion to apply the germanium selenide stoichiometries studied therein to a memory cell. Lack of motivation to combine the references cited is reason enough to withdraw the 35 U.S.C. § 103(a) rejection.

Additionally, the Office Action sets forth no evidence that one of ordinary skill in the art would have had a reasonable expectation of successfully combining the references to achieve the claimed invention. In fact, a person of ordinary skill in the art would not have had a reasonable expectation of success when combining the Kozicki and Mitkova references. There is no suggestion in either reference that the stoichiometries disclosed in Mitkova may be successfully substituted in the devices disclosed in Kozicki '115 and Kozicki '106 to obtain a functional memory cell. Furthermore, Mitkova discloses a large range of potential germanium selenide stoichiometries, and neither Mitkova nor Kozicki '115 provide any suggestion of which of those disclosed ranges are even capable of being successfully utilized in a functional memory cell. Kozicki '106 suggests only that a germanium selenide stoichiometry $Ge_{30}Se_{70}$ may be utilized in a functional memory cell, but discloses the incorporation of silver to be "self-limiting." Mitkova, on the other hand, without recognizing the implications for memory cell production, emphasizes the possible effect of the amount of silver on the phase (i.e., crystalline versus non-crystalline) of a germanium selenide glass. These greatly disparate teachings – the Kozicki '106 teaching that no limitation of silver content is required for a functional memory device on one hand, and the Mitkova teaching that silver content is a factor in the phase of a chalcogenide material (without

apparent understanding of the relevance of this teaching to memory devices), on the other – would have undermined the expectation of success held by one of ordinary skill in the art.

Additionally, it is clear, based on the named inventors of U.S. Patent No. 6,635,914, that since Kozicki and Mitkova have been aware of each other's work, even those of higher than ordinary skill in the art would not have had a reasonable expectation of success for combining the teachings of Kozicki '115, Mitkova, and Kozicki '106 to form the memory cell of the claimed invention.

Furthermore, even if there were a motivation or suggestion to combine the teachings of Kozicki '115, Mitkova, and Kozicki '106, and a reasonable expectation of success in doing so, the combined teachings of Kozicki '115, Mitkova, and Kozicki '106 still do not disclose all the elements of the non-volatile memory cell recited in claim 11. Specifically, neither the Kozicki references nor Mitkova teaches or suggests limiting the amount of silver included in a germanium selenide glass "to a stoichiometric amount of silver suitable to maintain said germanium selenide glass in a non-crystalline state," as recited in claim 11.

The Kozicki references describe chalcogenide materials including dissolved silver. See, e.g., Kozicki '115, col. 5, lines 20-31. Regarding the amount of silver to be dissolved, however, Kozicki '115 states: "Preferably, sufficient silver is deposited on the chalcogenide surface to form the equilibrium phase throughout the chalcogenide layer." See col. 5, lines 40-42. Kozicki '106 states that the dissolution of metal into a chalcogenide glass is thought to be "self-limiting." See col. 6, lines 18-21. Neither Kozicki '115 nor Kozicki '106 suggests limiting the amount of silver dissolved into a germanium selenide glass to maintain the germanium selenide glass in a non-crystalline phase. While Mitkova discusses various stoichiometries of germanium

selenide glasses containing silver, it also fails to teach or suggest the requirement to limit the amount of silver dissolved into a germanium selenide glass to maintain the germanium selenide glass in a non-crystalline phase, as recited in claim 11 of the present application.

Apart from the amount of silver included in the germanium selenide glass, the Office Action specifically cites Kozicki '106 as evidence that the germanium selenide glass stoichiometry recited in canceled claim 15 (now recited in claim 11) was well known at the time of the application. Applicant respectfully submits that this is not accurate. Kozicki '106 discloses only Ge_3Se_7, and the argument that this renders the stoichiometric range recited in claim 11 lacks factual support, and apparently results from a misunderstanding about the claimed range compared to the range disclosed in Kozicki '106.

Claim 11 includes germanium selenide Ge_xSe_{1-x} stoichiometries where $0.39 \leq x \leq 0.42$. In other words, the stoichiometries included in the present invention range from $Ge_{39}Se_{61}$ to $Ge_{42}Se_{58}$. The germanium selenide is 39% germanium at the lower boundary and 42% at the upper boundary of the present invention, which is very different from the Ge_3Se_7 disclosed in Kozicki '106. The Office Action incorrectly states that Kozicki '106 discloses a germanium selenide stoichiometry with 43% germanium. Kozicki discloses Ge_3Se_7, which is the same as $Ge_{30}Se_{70}$, representing a germanium selenide with 30% germanium and 70% selenium. This stoichiometry differs significantly from even the lower value of the range included in the claimed invention. Applicant submits that more than mere routine experimentation with the teachings of Kozicki '106 would have been required to achieve the germanium selenide stoichiometries recited in claim 11. Therefore, Kozicki '106 does not teach the germanium selenide stoichiometries recited in claim 11.

Since (a) the Office Action fails to demonstrate any motivation or suggestion in Kozicki '115, Mitkova, and Kozicki '106 to combine the teachings of those references; (b) one of ordinary skill in the art would have no reasonable expectation of success in combining the teachings of Kozicki '115, Mitkova, and Kozicki '106; and (c) the combined teachings of Kozicki '115, Mitkova, and Kozicki '106 do not disclose all the limitations in claim 11 as amended, *prima facie* obviousness has not been established with respect to these references. Applicant respectfully submits that claim 11 as amended is allowable over Kozicki '115, Mitkova, and Kozicki '106.

Claims 25, 31, 36, and 42 recite similar limitations of claim 11 as amended and are therefore also believed to be allowable over Kozicki '115, Mitkova, and Kozicki '106 for the reasons set forth above and on their own merits. Specifically, claim 25, as amended, defines a memory cell and recites "germanium selenide glass having the formula $(Ge_xSe_{1-x})_{1-y}Ag_y$, wherein $39 \leq x \leq 42$." Claim 31, as amended, defines a method of forming a memory cell and recites the steps of "providing a germanium selenide glass having the formula $(Ge_xSe_{1-x})_{1-y}Ag_y$, wherein $39 \leq x \leq 42$." Amended claim 36 defines a method of operating a memory cell and recites "applying a voltage across a germanium selenide glass having the formula $(Ge_xSe_{1-x})_{1-y}Ag_y$, wherein $39 \leq x \leq 42$." Amended claim 42 and claim 43 dependent therefrom define a processor system and recite, in part, "a germanium selenide glass having the formula $(Ge_xSe_{1-x})_{1-y}Ag_y$, wherein $39 \leq x \leq 42$." Claims 25, 31, 36, 42, and 43 include limiting the amount of silver added to the germanium selenide glass to maintain the germanium selenide glass in a non-crystalline state. Claims 25, 31, 36, 42, and 43 should therefore be allowed for at least the reasons recited above with respect to claim 11.

Applicant also directs the Examiner's attention to U.S. Patent No. 6,635,914 to Kozicki and Mitkova (hereinafter "Kozicki '914") cited in IDS form PTO/SB/08 filed herewith. Kozicki '914 issued from U.S. Patent App. Pub. No. 2002/0168820 (hereinafter

Kozicki '820"). Applicant submits that neither Kozicki '914 nor the published application, Kozicki '820, discloses or suggests the subject matter claimed in the present application.

As stated above, claim 11 of the present application recites a "non-volatile memory cell comprising: a germanium selenide glass comprising silver, said germanium selenide glass having the formula $(Ge_xSe_{1-x})_{1-y}Ag_y$, wherein $39 \leq x \leq 42$ and y corresponds to a stoichiometric amount of silver suitable to maintain said germanium selenide glass in a non-crystalline state; and a first electrode and a second electrode electrically coupled to said germanium selenide glass." See claim 11 (emphasis added).

While Kozicki '914 discloses that "[a]n exemplary chalcogenide glass with dissolved metal in accordance with the present invention includes a solid solution of ... Ge_xSe_{1-x} ---Ag ... where x ranges from about 0.1 to about 0.5," (see col. 9, lines 2-9; see also claim 10), Kozicki '914 fails to disclose the feature of the present invention that a metal, such as silver, may be included only in an amount so as to maintain the germanium selenide glass in a non-crystalline phase.

Although Kozicki '914 states that incorporation of silver into a chalcogenide material is thought to be self-limiting when photodissolved, col. 9, lines 56-65, Kozicki '914 does not disclose the importance of limiting silver incorporation to maintain the chalcogenide glass in a non-crystalline state. On the contrary, Kozicki '914 discloses an alternative embodiment using thermal dissolution instead of photodissolution. Col. 10, lines 16-22. Even though silver incorporation is not self-limiting when silver is thermally dissolved into a chalcogenide glass, Kozicki '914 fails to disclose limiting silver incorporation when using thermal dissolution. Kozicki '914 does not recognize the importance of limiting silver incorporation to maintain the germanium selenide glass.

Furthermore, as mentioned above, Kozicki '914 discloses germanium selenide glasses with dissolved silver having the formula "Ge_xSe_{1-x} ---Ag ... where x ranges from about 0.1 to about 0.5," col. 9, lines 4-9. Many values of x within this range result in undesirable crystalline germanium selenide, showing that Kozicki '914 does not even recognize the importance of maintaining the chalcogenide glass in a non-crystalline state. Obviously, Kozicki '914 does not disclose limiting the amount of incorporated silver to maintain the germanium selenide glass in a non-crystalline state if it does not recognize the underlying importance of maintaining the germanium selenide in a non-crystalline state in the first instance. For at least this reason, claim 11 and the other pending claims in the present application (which include similar limitations) are believed to be allowable over Kozicki '914.

Claims 24 and 32 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kozicki '820 in view of Kozicki '115. Independent claim 27 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Kozicki '115 in view of Kozicki '820. Independent claim 37 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Kozicki '820, or, in the alternative, over Kozicki '820 in view of Japanese Patent No. JP403044703 to Anjo. Applicant respectfully traverses these rejections.

Claim 24 as amended recites a memory cell comprising "a germanium selenide glass comprising silver, said germanium selenide glass having the formula $(Ge_xSe_{1-x})_{1-y}Ag_y$, wherein $18 \leq x \leq 28$ and y corresponds to a stoichiometric amount of silver suitable to maintain said germanium selenide glass in a non-crystalline state; and at least two electrodes electrically coupled to said germanium selenide glass."

As described above, the references cited in the Office Action, taken individually or in combination, fail to disclose providing silver in a stoichiometric

amount suitable to maintain a germanium selenide glass in the non-crystalline state. As with Kozicki '914 described above, the Kozicki '820 published application cited in the rejection of claim 24 set forth in the Office Action does not recognize the importance of maintaining the chalcogenide glass in a non-crystalline state and does not disclose limiting the amount of incorporated silver to maintain the germanium selenide glass in a non-crystalline state. Likewise, neither Kozicki '115 nor Mitkova discloses limiting the amount of incorporated silver to maintain the germanium selenide glass in a non-crystalline state. For at least this reason, claim 24 should be allowable and the rejection under 35 U.S.C. § 103(a) should be withdrawn.

Independent claims 27, 32, and 37 recite similar limitations to claim 24 and should therefore also be allowed. Claims 28-30 depend from claim 27, claims 33-35 depend from claim 32, and claims 38-41 depend from claim 37; accordingly these dependent claims should also be allowable.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

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Respectfully submitted,

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